Apatite exsolution as an indicator of Udachnaya grospydite UHP history

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Earth's mantle interiors characterizing by their heterogeneous composition contain a small fraction of rare rock types. Grospydite xenoliths well studied in kimberlites of Daldyn-Alakit region (Yakutia, Russia) [1, 2] are of special interest among the representatives of unusual rocks composing mantle. We represent new data on mineralogy and evolution of grospydite xenolith LUV134/10 from Udachnaya kimberlite pipe (Yakutia).

Kyanite and Grt-1 are poikiloblastically included into the Cpx-1. Grt-2 + polycrystalline Qtz compose large (up to 8 mm) symplectites. Cpx-1 is nearly all replaced by tiny Cpx-2 + Pl symplectites and preserved in relics and inclusions in kyanite and garnet. Kyanite usually contains quartz inclusions, some of them may indicate their high-pressure origin [3]. Minerals contain evident exsolution textures. Grt-1 comprise numerous rutile and apatite needles. Kyanite is with rutile lamellae. Cpx matrix has Rt + Ilm rods, and Cpx-1 relics contain tiny apatite precipitates (confirmed by Raman).

Grossular garnet usually has 3.02-3.04 Si apfu and Na_2O up to 0.15 wt %. Cpx-1 is omphacite with significant admixtures of Ca-Ts and Ca-Es components (7 and 4 mol. % respectively). The presence of majoritic component in preserved garnet suggests its stability at pressures > 6 GPa, but reconstructions of original garnet composition presumably will raise the bar. Apatite precipitation in Cpx-1 allows us to declare original pyroxenes could have had about 200-400 ppm P. Considering experimental data [4], precursor pyroxene is believed to be stable at pressures no less than 6 GPa. Thus, the further findings of apatite lamellae in pyroxenes may serve as reliable indicator of ultra-high pressure stage in rock history.

With respect to mineralogical data we suppose the rock to be subjected to successive decompression and cooling within mantle reservoir.

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Grain size and REE patterns as tools to identify coastal depositional environments in Moreton Bay (southeast Queensland, Australia)

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Statistical grain size analysis of Holocene sediments across Moreton Bay revealed three different depositional environments: fluvial, aeolian and marine-tidal. The distribution of rare earth elements (REE) and yttrium was analyzed in each type of deposit to assess their suitability as a geochemical indicator of depositional environments.

Fluvial deposits are characterized by almost flat REE patterns and a positive Eu anomaly. In contrast, aeolian deposits are enriched in heavy REEs (HREE) relative to light REEs (LREE), and show a negative Eu anomaly. Fluvial deposits are enriched in REEs compared with aeolian deposits. Tidal deposits along small embayments are enriched in LREE relative to HREE, but show variable Eu anomalies. Relative to Ho, Y shows a strong negative anomaly in some of the fluvial sediments, but only a slight negative anomaly in tidal sediments. In contrast, Y/Ho>1 values characterize aeolian sediments. The presence and abundance of organic matter within the deposits does not seem to have any influence on REE abundances and patterns.

In general, total REE concentrations mimic Th distribution across all depositional environments, and the extent of LREE/HREE fractionation correlates with Nd/Fe ratio [1]. The distribution of europium anomalies (Eu/Eu*) [2] is consistent with variations in Hf, Nb and Zr distributions.

This study confirms that REEs are a powerful geochemical indicator of depositional environments even in a complex and dynamic setting such as a tidal estuary.

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